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POLICIES AND MECHANISMS FOR ACHIEVING SUSTAINABLE DEVELOPMENT

Report by the UNCTAD secretariat

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Introduction

Mandate

1. The Trade and Development Board in its decision 384 (XXXVII), paragraph 5, requested:

> The Secretary-General of UNCTAD, taking into account studies undertaken in other appropriate fora, to prepare an analysis, if possible for the first part of the thirty-eighth session of the Trade and Development Board, of the issue of sustainable development, in particular the reduction of poverty and its interface with policies and mechanisms in environmentally sensitive sectors, such as agriculture, energy, industry and transport, as well as with relevant structural policies such as those relating to the enterprise sector.

Coverage

2. The elements raised in that decision are numerous and complex. This report is therefore a first response. It does not attempt to cover all the issues or even to treat exhaustively those which it does examine. It focuses on an analysis of policies and mechanisms, striving to present a systematic classification of them, relating them to each other, to policy objectives and to the broader context of development. As far as possible, it presents terms which are clearly defined in existing international instruments or documents of the United Nations or of the Organization for Economic Cooperation and Development (OECD). It is hoped that it will incidentally contribute to international standardization and help avoid misunderstanding about terminology in the international negotiations now gathering momentum on sustainable and environmentally sound development.

3. The report does not attempt to assess the relative merits of different policies and mechanisms. Chapter I restricts itself to describing the concepts. Chapter II applies the analysis to one sector, transport, as an example of the concepts in motion in a specific policy environment.

4. The paper shows that further exploration is needed of a number of conceptual and policy issues with an important bearing on sustainable development, and in particular on the trade and development of developing countries. Among them, technology, resource management and the roles of the Polluter-Pays and User-Pays Principles deserve particular mention. The secretariat is pursuing its work on these questions in accordance with decision 384 (XXXVII).

Leading implications

5. Three main sets of substantive implications of this report deserve to be underlined at the outset.

6. Firstly, in the perspective of sustainable development and poverty reduction, the solution to environmental problems which arise within particular sectors must be sought beyond sectoral boundaries. Chapter II takes the example of large cities - a major and rapidly growing issue in their

own right in developing countries. Appropriate spatial planning or, even more fundamental, appropriate choice of economic strategies would not only alleviate the environmental impact of big cities, but would also improve the living conditions of both the urban and the rural poor. Policies and mechanisms are no substitute for strategies (Figure 1.1), they can only influence their implementation.

7. Secondly, only simple problems can be tackled by a single policy or mechanism. For most of the issues involved in the interface between sustainable development and environmentally sensitive sectors, a mix of policies and mechanisms is indispensable. The specific nature of the mix depends on the institutional structures and capacities in the areas directly concerned. Chapter I argues that economic mechanisms can be convenient in many institutional circumstances, and that they should certainly be used whenever appropriate. It points out, however, that economic mechanisms to deal with environmental issues will function only if legal measures have created the framework within which they can operate.

8. Lastly, the analysis in this report confirms the perspicacity of the World Commission on Environment and Development which observed that one of the two key concepts of sustainable development is "the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs". 1/ In Figure 1.2, technology appears at the bottom of the diagram as the point where all policies and mechanisms converge. Any policy mix will influence technological effort. In the diagram, social organization appears at the top, as a set of constraints (or "if" - conditions) influencing which decision-making processes or policy mixes can be effective in particular places.

9. Both technology and social organization feed back into the system. Technology influences the relative merits of different policies and mechanisms. For instance, as the number of ways grows in which the economy affects the environment, and indeed as the relations between these impacts become more complex, decentralization of decision-making through economic mechanisms may become more effective, or conversely, the increasingly imponderable hazards may call for simple prohibitions as an expression of the principle of precaution. Technology expresses a cultural model. 2/ Whatever line its development takes, it will feed back into social organizations. Meanwhile, there is likewise a reciprocal relation between social organization and technological capability, e.g. through education in its broadest sense. Technology also feeds back into other aspects of institutional capacity. In short, policies and mechanisms are more than mere instruments: they play a significant role in shaping the whole development process.

I. Policies and Mechanisms

Introduction

10. This chapter presents a classification of policies and mechanisms for achieving sustainable development. It eschews any attempt to invent new kinds or categories of policy or mechanism. On the contrary, it follows as far as possible terms and classifications already accepted in the international community. Insofar as the chapter offers a new perspective, it is in the way in which it displays the relationship between these concepts and the various routes by which they are influenced by or themselves influence broader objectives and the development process as a whole. These relationships are presented in Figure 1.2. The text of this chapter expands on this figure, reading it from top to bottom.

11. Although an underlying theme of this chapter is that each policy and mechanism has its advantages and disadvantages in a given context, the choice of instrument nevertheless depends on a proper assessment of how it would function in a given context. It is beyond the scope of this chapter to undertake an examination of the different contexts necessary to determining recommendations about the relative merits of different measures.

12. This chapter focuses on policies and mechanisms which influence the behaviour of categories of actor within the economy - particular sectors or types of enterprise, consumers, etc. They could be described as meso-economic measures, in contrast to macro-economic policies which affect the economy as a whole or micro-economic measures which concern individual agents within the economy.

13. Policies, mechanisms and other words like "objectives" have variable meanings. For clarity, figure 2.1 presents a working definition of policies and mechanisms. They are both instruments. A mechanism is a means of implementing a policy, while a policy is a means of achieving a goal. There may be a number of policies to serve a particular strategy just as there may be a variety of mechanisms to implement a particular policy.

The limitations of the market

14. Market failures. There are a number of ways in which the free market fails to reflect costs and benefits. When failures occur, the market provides misleading signals. These failures are described in a earlier report by the secretariat under the headings of resource depletion, collective goods, externalities, and risk and uncertainty. 3/ In the following paragraphs, some of these points are developed further and other market failures in addition to the above are described. These failures spring from two of the key concepts within the definition of sustainable development.

15. Future generations. Sustainable development involves meeting the needs of the present without compromising the ability of future generations to meet their own needs. 3/ There is strong insistence on sustainable development as requiring sustainable output, thus extending to the economy as a whole the concept of sustainability as expressed for example in the sustainable yield of fish from a pond. Depleting the resource should be regarded as capital

consumption rather than as income. 4/ Income is indeed defined as the maximum amount that the recipient can consume in a given period without reducing the amount of possible consumption in a future period. This income concept encompasses not only current earnings, but also changes in asset positions: an increase in capital corresponds to income, and capital losses should be deducted from income.

16. The market does not, however, preserve this neat conceptual distinction between capital and income. There is one set of economic operations by which an agent acquires liquidity - land may be sold, a tree felled or wages earned by work. In a separate operation, the agent decides what to do with the liquidity he has thus acquired - consume it or save it. The market provides no automatic link between the two decisions. The desperate poor may consume capital if the need is urgent, but so also may the rich. Even if a person wished to save, institutional or macroeconomic factors (e.g. inflation) could result in any savings being consumed elsewhere in the economy rather than being invested.

17. The rate of interest in its guise of rate of discount assigns a present value to the future which diminishes down the road. Future costs and benefits alike rapidly become quite insignificant. Discounted at the rate of 15 per cent, one dollar in 33 years is worth only as much as one cent today. At 20 per cent, the corresponding number of years is 25. Fifteen to 20 per cent is a reasonable internal rate of return for a firm while 25 years is about one generation. Thus, sensible business decisions treat any period beyond one or two generations into the future as insignificant. If the discount rate were only 5 per cent, the corresponding time horizon would be 95 years, that is three or four generations hence. It is increasingly being said in government and business as well as in non-governmental organization (NGO) circles that sustainable development requires a longer-term view: e.g. "achieving economically and ecologically sustainable growth demands longer-term time horizons than those currently employed". 5/

18. If such development is to be achieved through market forces, interest rates must be lower. 6/ Unfortunately, the rate of interest is also the price of capital, as it serves to allocate capital between competing uses at any one point in time. A lower rate of interest in a free market would normally generate excess demand for capital.

19. National accounts aggravate this situation through their selective indicators to portray the economy. These accounts grew historically out of Keynesian management of the economy, which had focused on maintaining full employment. Keynesian analysis had largely ignored the role of natural resources in generating income. With the spread of standard national accounts through the Third World by means of the United Nations System of national accounts, 7/ low-income countries - which are typically dependent on natural resources for employment, revenues, and foreign exchange earnings - were advised to use a system for national accounting and macroeconomic analysis that almost completely ignored their principal assets. 8/

20. Priority to the poor. Welfare economics as taught in the Western tradition demonstrates that if the market meets all the relevant conditions it will maximize welfare in the particular sense that no person's welfare can be

increased without diminishing someone else's. The distribution of welfare depends on the initial distribution of income and wealth. By declining to compare the welfare of one person to that of another, this tradition is at odds with the requirement of sustainable development whereby overriding priority should be given to the essential needs of the poor. Each agent has a weight in the market, corresponding to his or her endowment of income and wealth. The poorer one is, the smaller it is. The poor have little weight in the market.

21. Not only do the poor have little weight in the market, they are often also largely outside the market. In developing countries especially, the poor meet an important part of their needs by direct self-provisioning. They depend on resources governed by rules different from those of the monetary economy.

22. The poor are not just people who have less than the rich, their numbers also comprise those who are different from the rich. In this light, indigenous peoples merit particular care. The right to be different, including the right to meet one's needs through means of social organization different from the market economy has been recognized in the ILO Indigenous and Tribal People's Convention 1989 of which Article 2 reads: 9/

> 1. Governments shall have the responsibility for developing, with the participation of the peoples concerned, coordinated and systematic action to protect the rights of these peoples and to guarantee respect for their integrity.
>
> 2. Such action shall include measures for:
>
> (b) Promoting the full realization of the social, economic and cultural rights of these peoples with respect for their social and cultural identity, their customs and traditions and their institutions;
>
> (c) Assisting the members of the peoples concerned to eliminate socio-economic gaps that may exist between indigenous and other members of the national community, in a manner compatible with their aspirations and ways of life.

23. The poor have little wealth. Wealth can be a cushion, absorbing economic shocks such as a fall in income, loss of employment or crop failure. Wealth allows one to look further into the future, to innovate - which involves taking risks. The poorer one is, the more one is constrained to deal with meeting immediate needs. Indeed, it is because of the immediacy of the essential needs of the poor that overriding priority is due to their needs: 10/ they must be met before the other demands of society, because the others can more easily wait.

24. To sum up this section, the market is a set of mechanisms which can be trusted to manage large parts of the economy in a conveniently decentralized manner. These mechanisms are particularly good at allocating resources to meet the demand of those who can pay. The market cannot, however, cope unassisted with every economic problem. In particular, it requires help in dealing with problems of collective goods, externalities and uncertainty. Its

limits are particularly evident with respect to sustainable development, which focuses on justice between generations and the priority due to the poor. The market is also unable to deal spontaneously with a number of major questions which arise at the interface of environment and economy. However, if suitable legal constraints are provided, circumstances can be created in which market mechanisms can conveniently serve environmental policies.

Mechanisms for implementing environmental policy 11/

25. The relationship between mechanisms for implementing environmental policy are illustrated in Figure 1.2. This section explains and expands upon the diagram.

26. Mechanisms function in a context. The given context determines the likely effectiveness of one type of mechanism relative to another. The role of a mechanism is to implement a policy (Figure 1.1). Policies to achieve sustainable development will not be examined in this chapter, but some of them will be taken up in chapter II. Chapter II is about transport policy; it also discusses the contribution of investment policy and physical planning (spatial policy) to transport policy. There can also be policies concerning the use of mechanisms directly, such as information, procurement or price policy.

27. The following paragraphs discuss the context before turning to particular mechanisms. One of the key concepts in definition of sustainable development advanced by the World Commission on Environment and Development is "the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs". 12/

28. Technology appears at the bottom in figure 1.2 as a node at which all the mechanisms ultimately converge. Technology is itself a mechanism for implementing environmental policy. Particular technologies can be developed to meet specific environmental needs. The diagram illustrates technology as both a mechanism and as a feature of the context. The development of technology in turn determines the direction in which the economy moves through time. It can indeed be towards sustainable development if the mechanisms have been chosen and operated to that end.

29. Social organization appears at the head of the diagram in the guise of valves which, to varying degrees, may open or block one route or another. The policy mix should, in the normal course of events, vary from place to place as a result of differences in social organization. It is axiomatic that any policy will be only as successful as the manner in which it is implemented. Any environmental policy mix, whether based on regulations or market mechanisms, must take into account the administrative, managerial and institutional structures of the countries concerned. This includes implementation, monitoring and enforcement capabilities.

30. This is not to say that policy options which are otherwise valid should be discarded simply because they are not suited to the existing institutional structure. Rather, there should be a flexible process in which policies are adapted to institutions and institutions are adapted to good policy options. However the limitations of the institutional structure must first be recognized, along with the fact that time, money and expertise is essential in order to modify them.

31. Indeed, social organization determines at the outset whether an environmental problem is perceived as a policy issue at all. Two steps are involved in this. Firstly information is indispensable. If there is no awareness that a problem exists, no steps will be taken to solve it. Regardless of the policy mix, measures will be more successful if they have the support and confidence of the public. The public must be aware in order to be able to make informed choices. A high governmental priority should therefore be to educate citizens about environmental risks, the economic and health dangers of resource degradation and the real costs of environmental attributes. This is becoming both more difficult and more important as environmental issues, laws and regulations increase in number and complexity.

32. Likewise, Government needs to seek public support for its regulations, standards and indeed for market mechanisms as well. Without public support, they are likely to fail before they achieve their long-term goals of sustained growth, resource conservation and poverty reduction.

33. Secondly, social organization must be such that those who are concerned about environmental problems can raise them as an issue. As a rule, if environmental questions become problems for suitably organized groups in society, they will be taken up politically. The primary outputs of the political process are laws, regulations or administrative measures. Legal and regulatory measures can serve either as direct constraints on behaviour, as command and control instruments, or as a means of establishing a framework of constraints within which the decentralized market can reflect environmental considerations more fully.

34. The machinery of government is subject to the political process, to a degree in a manner shaped by social organization. In most countries, the public sector is a major, if not the largest, actor in the economy. Its own procurement activity has a significant influence on the market. Government purchasing decisions have an impact on what is available to the economy as a whole. If the Government insists on buying environmentally sound products, this alone will make them more readily available to other purchasers. The public sector is often a major supplier of infrastructure and public services. For instance, Government choice between private or public transport will have far-reaching impacts on the environment and sustainable development. 13/

35. Procurement by the public sector is big enough to influence not only prices, but also technology. The prospect of a large sale can stimulate suppliers to meet the buyer's technical requirements. However, the total government budget of many developing countries is small, relative not only to that of most developed country governments but also vis-à-vis other public bodies or large firms in developed countries. The leverage which public sector procurement offers in developing countries should not be neglected of course, but neither should it be overestimated.

36. The public sector can itself support research and development, e.g. through contracts to institutions or enterprises, through support to universities and technical schools or by imaginative initiatives like public competitions. This, however, assumes a degree of leeway in financial and human resources which is greater in developed that developing countries.

37. Management may be more or less responsive to the requirements of environmental protection or of sustainable development. Making management conscious of these objectives, providing it with incentives to work towards them and providing the training to help them do so are all administrative measures.

38. The public sector can also be required to collect and disseminate information pertinent to sustainable and environmentally sound development. It may be an internal management tool or it may be published. In the latter case, it becomes an input into the political process, as mentioned above.

39. Enforcement of the law is an essential function of government. Environmental standards actually in force ultimately depend on the quality of enforcement, and this in turn depends not only on the financial, human and technical resources available to enforcement agencies but also on the degree to which public opinion is aware, concerned and able to make its opinion felt about violations.

40. It is the responsibility of management to assure respect for norms and standards established either by the firm - individually or through voluntary Agreements - or by the authorities. The degree to which this responsibility is exercised will again influence the standards which actually apply.

41. The foregoing observations have been expressed in reference to the public sector but similar arguments may be applied to enterprises in the private sector as well. Their meso-economic impact may be smaller, although this is not necessarily so in the case of large transnational corporations. The firm's own purchasing and investment decisions, the sums it devotes to research and development and the orientation it gives to these efforts, all influence the types of goods available on the market, the structure of prices and the development of technology. The effectiveness of management and the attitudes encouraged by employers with respect to environmentally sound and sustainable development will affect the contribution of the firm to the sustainability of development in general. Enterprises have implicit or explicit information policies: management procedures determine the kinds of information which go into corporate decision-making. Corporations may wish, and in more cases should be required, to make information public in order to improve control and the enforcement of standards as well as to facilitate informed political debate.

42. Given the limited legal, financial and technical resources of developing countries, their environmental standards and the policies and mechanisms chosen to enforce them need to be simple and cost-effective. Choosing whether to use legal and regulatory measures directly or to establish a framework within which economic ones can function is a practical question. The most effective solution should be sought in the light of institutional capacity and structures, i.e. depending on the state of social organization. The choice of environmental policy instruments can be made against five sets of criteria: environmental effectiveness, economic efficiency, equity, administrative feasibility and cost, then, lastly, acceptability. 14/ Whatever instruments are chosen, their actual performance must be monitored to ascertain how they perform in practice, as well as to keep pace with the evolution of both environmental problems and techniques of environmental protection.

43. The environmental impacts and interactions of products and processes are increasingly intricate. They may not be obvious to the untrained eye. Some have become so complex that they are not obvious even to the trained eye. One response to this complexity has been the "precautionary principle", whereby, when confronted by threats of serious or irreversible environmental damage, lack of full scientific certainty will not be used as a reason for postponing measures to prevent environmental degradation. 15/ In any event, it may be necessary to impose information requirements on economic agents if the political process is to be equipped to deal effectively with environmental problems. One way in which developed countries can help developing countries is simply to ensure that the information they need is available to them. In this respect a device as simple as prior informed consent (see also para. 57) can play a useful role.

44. International trade requires a degree of harmonization in policies and mechanisms for achieving environmental objectives. It should, however, be stressed that international harmonization covers a variety of meanings. 16/ "Harmonization" is considered here as a generic term encompassing several forms of concerted action such as (a) uniformity of standards. In a trade perspective, it is important to distinguish further between (i) uniform product or emission standards and (ii) uniform standards of environmental quality; (b) uniformity of policies; (c) agreement on common policy instruments while leaving freedom to each country to adapt their implementation and form; (d) agreement on common principles (e.g. the Polluter Pays Principle, sometimes abbreviated to simply PPP). Consequently, differences in environmental standards continue to exist, even among developed countries.

45. Command and control measures can have the virtue of simplicity, especially when they embody outright bans or obligations, assuming these can be enforced. Direct regulation and control are appropriate when, for example, it is imperative wholly to prohibit emissions of certain toxic pollutants or the use of hazardous products or substances 17/ or when a clearly defined step must be taken to protect the environment.

46. Environmental regulation has been most successful in developed countries when dealing with large fixed point sources of pollution such as factories, power plants or landfills. Laws and regulations of this kind put firms in a clear and predictable situation, thus making it easier for them to plan their activities.

47. All regulatory schemes have some type of legal enforcement mechanism. Generally, the relevant governmental agency sets an environmental standard for an activity or substance. Should it not be met, it is the job of Government to bring an enforcement action against the violator. Depending on the regulatory and legal system operating in the country, this action could be brought either administratively or in a court of law. Administrative or judicial litigation brought by the government has among its expected outcomes that the violator will be faced with a fine, penalty or court costs and will thereafter comply with the regulation.

48. Some national legal schemes also provide for citizen suits against the government's environmental agency, in order to compel it to enforce the standards set. In common law countries, an individual or group may pursue a legal action against the polluter for damages to their health or property. These law suits, called torts, are based on traditional common law nuisance theory.

49. Under a civil law regulatory system, litigation may not be as frequent or as slow, but since it is based on a regulatory code which is as complex as that in common law countries, it is also costly. And, although the process is generally faster than in many common law systems, access is not normally as liberal for the public at large. Thus there is reliance on government enforcement for the most part. This approach may therefore be less effective in adequately compensating individuals or groups who have been harmed by violations of environmental standards.

50. Regulation requires monitoring to make sure that there is compliance with the regulations. NGOs have often played a key role in environmental monitoring in both developed and developing countries. Recognizing their expertise and vigilance by granting them status in the regulatory system can be no less than cost-effective.

51. The industrialized countries have extensive, well-developed and costly legal structures with a wealth of experience in regulatory enforcement obtained long before the current growth of environmental regulation. Yet, even with many advantages, environmental litigation in the industrialized countries has proven to be slow, expensive and complicated.

52. In achieving regulatory goals, litigation is most effective when the regulations are clear and concise, and the enforcement actions timely and consistent. Litigation is indispensable in any regulatory system. Since regulation will continue to be a large part of any environmental protection scheme for the foreseeable future, developing countries should attempt to limit and simplify both their basic regulation framework and the role of litigation in enforcing it. The legal structure should ensure quick and consistent enforcement results. Voluntary and simplified arbitration provisions can play an important role in a developing country's legal enforcement structures. Indeed, even compulsory and binding arbitration could be adopted.

53. Governments themselves are important actors in the economy and with respect to the environment. They also play an important role in shaping social organization. Administrative measures can themselves be significant mechanisms for implementing environmental policy. By publishing information about the environment, governments can facilitate a rational political process. The publication of environmental indicators is one aspect of such an information policy. Governments can also promote environmentally sound technology through its own purchasing policy, by encouraging innovation in its supplies, and in general by supporting research and development with respect to environmentally sound technology.

54. Voluntary agreements constitute a non-economic mechanism for implementing environmental policy without the compulsion attached to laws or regulations. They provide means by which firms particularly alert to enviornmental issues can agree mong themselves on a proper response. They can set an example, encouraging others to follow. A recent example is the International Chamber of Commerce's Business Charter for Sustainable Development. 18/

55. The drawback with voluntary agreements is that only firms which subscribe to them need respect them. Adherence may involve extra costs (if not, all firms would presumably automatically behave in the desired manner). These firms supporting voluntary agreements thus accept a cost handicap: less scrupulous competitors can take advantage of that burden to undercut them. Laws and rules binding on everyone are not only likely to be more widely observed, but they avoid market distortions. While voluntary agreements may be useful in prearing the way, they are best seen as a stepping stone towards impartial legislation.

56. Laws, rules and voluntary agreements establish environmental norms and standards. These should be established at levels which reflect, on the one hand, the environmental characteristics and, on the other, the economic and social priorities of the place where the standards are to apply. There are pressures in international economic negotiations to impose uniform standards, not only for reasons of administrative simplicity, but also to reap the benefits of falling costs by helping large firms subject to increasing returns to scale. This is a matter which calls for proper technical analysis before political decisions are taken.

57. The number of environmental norms and standards is constantly growing. At the same time, they are becoming more detailed and technical. Not only is it increasingly difficult to keep up with them but also the reasons which justify them are not always known, especially in developing countries where specialist technicians are scarce. Hence the importance in North-South trade of the principle of prior informed consent, according to which an exporter of a hazardous product should notify the importer of the potential hazard and proceed with the shipment only after the importer has confirmed that it is aware of the dangers but accepts the product nonetheless. Hence also the importance of export restrictions or bans like those contained in the Basle Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal or similar regional agreement. They place the burden of responsibility for controlling the nature of shipments mainly on the countries best able to do so, i.e. the developed ones. Prior informed consent can also alert governments of developing countries to abstruse environmental hazards, thereby enhancing the information base on which sound environmental policy rests.

The Polluter-Pays and User-Pays Principles

58. The Polluter-Pays Principle (PPP) occupies a central place in Figure 1.2 and is seen by developed market economy countries as playing a central role in environmental policy. It was adopted by OECD countries in 1972 as the fundamental principle for allocating costs of pollution prevention and control. 19/ The principle essentially refers to internalization of the economic costs (control, prevention and residual damage) of the external effects (pollution) of production, consumption and disposal.

59. Internalization of these costs should, in turn, stimulate technological innovation in production, in pollution control and in products, with the aim of reducing the cost of pollution prevention and control. Consistent application of the principle should ensure flexibility, efficiency and cost-effectiveness in environmental policies. It would, in particular, avoid potential distortions in international trade and investment.

60. PPP recognizes that the agreed costs of pollution avoidance or repair should in the end fall on the final consumer (with all the provisos arising from the shapes of supply and demand curves). In so far as consumers face prices reflecting pollution, the pattern of their demand will reciprocally influence producers to choose less environmentally burdensome and consequently less costly products and processes.

61. Concerning environmental standards, PPP requires countries only to ensure that the environment is in an acceptable state. A political decision at the local, national or international level determines the norms or standards which correspond to an acceptable state of the environment. PPP allocates pollution costs between the polluter and the community through a political process. The polluter must pay the costs of meeting these norms while the community bears any residual costs of environmental degradation. As a result, standards (both ambient environmental quality and emission standards) may vary as justified by such factors as differences in the pollution assimilative capacity of the environment, degrees of industrialization, population densities, or social objectives and priorities attached to the environment.

62. Today, PPP is used in developed countries as an economic and moral rationale for the formulation and use of a mix of policy mechanisms. PPP has developed over the years as a framework for the effective use of economic instruments in conjunction with regulations. In addition, PPP is sometimes applied to financing mechanisms used to generate funds for pollution control - particularly for collective treatment facilities.

63. Most economic instruments are consistent with PPP, the only exception being subsidies. Acknowledging that exceptions may on occasion be warranted, PPP specifically recognizes that subsidies may be provided when the application of PPP without subsidies would "jeopardize the social and economic policy objectives of a country or region. This would be the case, for example, when the additional expenditure incurred by polluting industries would result in holding back regional development or adversely affecting the labour market". 20/ A subsidy, tax advantage or other similar measure should however be strictly limited, and in particular comply with every one of the following conditions:

(a) It should be selective and restricted to those parts of the economy, such as industries, areas or plants, where severe difficulties would otherwise occur;

(b) It should be limited to well-defined transitional periods, laid down in advance and adapted to the specific socio-economic problems associated with the implementation of a country's environmental programme;

(c) It should not create significant distortions in international trade and investment. 21/

64. Subsidies are considered consistent with PPP if they come from user or administrative charges to finance collective control facilities. A number of Governments apply subsidy schemes which are questionable as to their compliance with PPP. However, they justify them on the grounds that no government funds are involved - e.g. transfers between firms or from users to potential polluters.

65. Subsidies should be distinguished from income support. Sustainable development recognizes that the poor need support. Ideally, this involves ensuring that they have the means to meet their own needs through their own productive work. If this is not immediately possible, basic income should be provided through mechanisms of social solidarity. When the application of PPP would, taken by itself, lead to a reduction in the living standards of the poor (e.g. by increasing the price of an essential consumption good) the proper response would be not to subsidize that economic transaction, but rather to provide off-setting income support for the poor. Subsidizing particular activities can be inefficient, unfair and harmful to the environment, while income support for the poor can be set in the light of prices which reflect social and environmental costs to the fullest extent possible.

66. PPP also raises a problem if the poor are the proximate cause of pollution or environmental degradation (e.g. deforestation by the landless). One of the basic underpinnings of the price mechanism as a fair way of allocating resources is that the actors in the market have freedom of choice. However, the poor may have little freedom. PPP unaccompanied by measures to improve the economic situation of the poor, or at least to offer them an alternative, may make the plight of the poor even more desperate without relieving the environmental degradation.

67. PPP leaves Governments considerable freedom in their pollution control policies. They are free to select environmental standards appropriate to their particular economic conditions and social objectives. They have considerable discretion during the transitional period to implement the principle progressively. The principle can assist Governments in enforcing compliance by large polluters who usually can afford to pay for pollution control. It would provide foreign investors with greater transparency in undertaking investment in developing countries and encourage them to introduce more efficient clean technologies; they would also avert the accusation of escaping stricter controls in their home country by investing in developing countries at the expense of the latter's aspirations for sustainable and environmentally sound development.

68. It has already been stressed that institutional capacity and structures play an important role in determining the most effective policy mix. PPP would be difficult to apply in developing countries under conditions where there are a large number of small polluters, where there is no proper administrative and fiscal structure in operation, where the equity effects would be highly regressive, requiring income support that would be difficult to finance, and where property rights are not clearly defined in this regard.

69. In short, while there is a presumption in its favour, it remains to be established whether the general application of PPP in developing countries

would have the same beneficial effects as expected in developed countries, given that in developing countries poverty is more widespread and non-market considerations play a larger role in the economic decisions of the poor, indigenous peoples and other social groups who could have a significant impact on the environment as its destroyers or guardians. On the other hand, a more systematic application of PPP by developing countries might strengthen their hand in international economic relations, including relations with transnational corporations. The incidence of PPP in and on developing economies has so far been scarcely studied. It also remains to be explored how far and by what means PPP can actually be applied in different conditions of social organization. The UNCTAD secretariat intends to pursue these questions in so far as they bear on international economic relations.

Resource management

70. The proper management of resources is at least as important to sustainable development as the control of pollution. The quality and character of resource management depend to a large degree on the legal and regulatory measures applied to its management. The management of resources outside the market can be particularly important for the poor. Poor communities (in the sense of groups with little access to money) often have sophisticated mechanisms for managing the resource base on which they depend. When the development process brings these non-market forms of resource use into competition with market uses, sustainable development, with its objectives not only of poverty reduction but also of safeguarding the prospects of future generations, should give full weight to "traditional" forms of resource management. The need to specify the owners, their rights and their duties applies to common property resources as well as to those which are privately owned. A frequent institutional failure leading to misuse of resources is to treat common property as if all had access to it.

71. Regardless of whether they are preserved or abandoned in favour of "modern" economic methods, ownership rights and duties often need to be clearly spelled out and if necessary redefined in the light of the challenges which development sets forth for resource management. Indeed, economic mechanisms often perform poorly because ownership rights and duties have not been adequately or appropriately defined. An important issue is that resources may have multiple uses and that some of the uses can easily be reflected in market mechanisms while others cannot.

72. The User-Pays Principle. The User-Pays Principle (UPP) has been formulated at the basic principle in resource pricing whereby those who benefit should pay. UPP in its essential form calls for the user to pay for the full cost of the resource and its related services.

73. Since both PPP and UPP share the objective of requiring beneficiaries to cover all the cost of their activities, these principles may be regarded as two expressions of the same policy. In general, it is understood that PPP should cover pollution control costs while UPP would deal with pricing of natural resources, although some overlap between them is frequent. Such overlapping cases are, however, few and on the whole it is relatively easy to distinguish between the operations of the two principles.

74. The debate on the User-Pays Principle centres largely on "who is the user?" and "what should be paid for?" Users may be classified as follows:

(i) Consumptive users who consume, in some form, the environmental or natural resource, e.g. water for drinking;

(ii) Quality users who use the resource as a vector for the disposal of waste and by-products of their activities; e.g. cities discharging effluents into a river;

(iii) Passive users: neither consuming nor polluting; e.g. recreational water uses.

All types of users should be paying for their use of the resource according to the cost or use value.

75. The total economic value of a resource and the corresponding social opportunity cost of its use are illustrated in Figure 1.3. 22/ Although the concepts shown in the figure are often found in current literature on the economics of natural resources, their precise definitions and classification have not yet been pinned down. The concepts are presented in the figure from left to right, roughly in declining order of clarity, operational usefulness or degree of acceptance by the economics profession at large.

76. Direct-use value corresponds to output used by an intermediate or final consumer. Direct costs are those of inputs which the producer or user incurs.

77. The indirect-use values of resources include their indirect support and protection to other economic activities or environmental services. Some of these values correspond to externalities in so far as they cannot be appropriated by or charged to the user.

78. Social opportunity cost also includes any costs that the use of the resource now projects onto future users. These are called "user costs". 23/ For any future period, the user cost is the difference between the costs that users face and the costs they would otherwise face if the resource had not previously been used. 24/ It is a formula for measuring the cost imposed on future users by having inherited a depleted resource. Like externalities, user costs correspond to indirect use values.

79. Option value is the amount people would be willing to pay to preserve the option to use the resource in the future. Option value can also be taken to include the opportunity to gain information about the actual value of the resource as time passes. If the resource is destroyed, then the information base is to a large extent destroyed with it. 25/ Option values are on the borderline between use and non-use values.

80. Non-use values include the opportunity to pass the resource on to future generations, giving them the opportunity to benefit (bequest value). Lastly, people may attach value to the mere existence of a resource without wishing to use it or may reserve the possibility of using it in the future.

81. With respect to non-use values, social opportunity cost is a simple mirror image: in so far as the resource is used up, the non-use values are diminished; this gives rise to corresponding opportunity costs.

Economic mechanisms 26/

82. Economic mechanisms may prove particularly effective in influencing complex and diffuse chains of causation which lead to environmental degradation. Various types of economic mechanism can conveniently be distinguished.

83. Firstly, there are charges or taxes. The following types are often distinguished: emission or effluent charges, user charges, product charges and administrative charges. Emission charges are levied on the basis of the quantity of pollutant discharged. They may relate to the emission of pollutants into air or water or the soil; they may also be levied on the generation of noise. User charges are levied to meet the costs of treating effluent or waste. In fact, such charges correspond to the price charged for a service rendered. Just as one can charge a certain sum per unit of water consumed, so one can charge for each unit of used water treated. User charges are intended to cover costs of facilities used.

84. Product charges are levied on products the production, consumption or disposal of which are harmful to the environment. Depending on the nature of the product, the way in which it is used and the nature of the pollution it engenders, a product charge may be more practicable than an emission charge. Thus, for instance, petrol is used by a large number of consumers and it is directly or indirectly related to a variety of forms of pollution (greenhouse gases, NOx, smog, noise, etc.). Hence it is simpler to tax petrol than to try and identify the various specific forms of pollution engendered and to charge for each separately. Tax differentiation modifies the relative prices of products by penalizing those more harmful to the environment. It can therefore be regarded as a form of product charge.

85. Administrative charges are levied on administrative procedures. If the procedures are intended to protect the environment, the charges increase the cost of activities which may harm the environment (the procedures may also be time-consuming, which is another form of cost; in that regard, they also serve as regulatory measures).

86. Many developing countries have limited tax structures and limited means to collect taxes. With existing taxes compliance rates may already be low; there may be mistrust of the tax system and especially of its collection mechanism. For these reasons, environmental taxes are likely to be most effective if they could be simple in form and limited in application. Generally, taxation works best if it is centred on industrial activity and large point sources of pollution. If such a mechanism is used to influence the behaviour of the population at large (e.g. taxes on petrol), it should be placed as far upstream in the production process as possible in order to simplify collection.

87. A subsidy is the opposite of a charge or tax: the polluter receives financial assistance as an inducement to abate pollution. The subsidy must,

of course, be funded from somewhere. The funds may be drawn from general revenue - i.e. financed by the public at large - or they can be incorporated into a system also including pollution charges - i.e. the collectivity of polluters may provide the funds to support pollution abatement. Apart from the latter type of case, subsidies are as a rule incompatible with the Polluter-Pays Principle. The principle provides for certain specific exceptions. 27/

88. Taxes and charges can in many cases serve to feed funds, which can then be used for particular purposes. More generally, they may simply generate revenue for the authority levying the tax or charge. Indeed, experience in the OECD countries seems so far to indicate that environmental charges have been too low to influence behaviour significantly, although they have made a significant contribution to public revenues. 28/ The funds do not necessarily serve to finance pollution abatement, and it is unusual for them to be used to compensate the victims of pollution.

89. Marketable permits are quotas, allowances or ceilings on pollution emission levels which, once allocated by the appropriate authority, can be traded subject to a set of prescribed rules. They can also be used to encourage efficient use of scarce natural resources such as water. Marketable permits have the particular virtue of encouraging polluters always to improve their performance, since they can sell their unused pollution rights to others.

90. Deposit-refund systems involve paying a deposit on the acquisition of potentially polluting products and refunding the deposit when the product or its residuals are appropriately returned. Familiar with respect to drinks containers, it can also be applied to larger objects such as motor vehicles. Compulsory returns are a regulatory measure of similar effect. In some countries, sellers are required to take back toxic wastes in the form of medicines or used batteries, for example, or simply inconvenient materials such as wrappings. This approach helps to internalize the costs of disposal.

91. Many environmental impacts are dealt with in the form of risk or uncertainty. External costs occur only in the event of mishap. In so far as those exposed to the risks rather than those who create them carry the cost, the hazardous product or process is subsidized by the potential victims. There is a growing tendency to require the creator of the risk to shoulder a greater share of the liability.

92. Prices. The mechanisms described above, both economic and legal, affect costs and prices. Indeed, one of the objects of these mechanisms is to improve the signalling functions of the price system by incorporating environmental aspects of economic processes, so that the decisions of consumers and producers are taken in the light of a more complete range of their consequences.

Technology

93. Relative prices provide an incentive to technological innovation. Firms have an interest in reducing costs. In so far as economic mechanisms internalize the environmental costs of their activities, firms are encouraged to seek products, processes or activities which are less of a burden on the environment.

94. Legal or regulatory measures can also stimulate technological innovation. Most simply, it is a normal part of a firm's activity to seek cheaper ways of doing business. If it has to meet given environmental norms, it will include the search for cheaper ways of meeting them in its more general search for efficiency. It is not always necessary to invent a new technology. A more environment-friendly technology may be in use elsewhere. Hence to introduce particular norms may encourage the transfer of technology from one place to another.

95. Some authorities practise what might be called forward-looking norms: they set standards which cannot be met today but are aimed for a fixed date in the future, thereby pressing the interests concerned to develop means of meeting the requirement by the deadline. The requirement imposed by Los Angeles (California, United States) whereby from 2 per cent of vehicles sold by 1988 to 10 per cent of those sold by 2003 must meet a "zero emission" norm will undoubtedly prove a significant stimulus to develop new forms of motor vehicle on a world scale, given the size of the Los Angeles market.

96. The problem is not only to develop environment-friendly technologies, but to ensure access to them, in particular by users in developing countries. A large share of international technology transfer takes place within firms. This is especially the case with respect to environment-related technologies; as most of them are new, they are often "locked up" in enterprises, while the older, more polluting, technologies are more easily available. Conversely, developing countries often possess environment-friendly technologies which could be more effectively exploited there or indeed exported to other countries. 29/ Cultural, institutional and financial obstacles hinder the South-South and South-North spread of such technologies. These questions go beyond the scope of this paper.

Conclusions

97. The market does not spontaneously take the key issues of sustainable and environmentally sound development into its functioning. If economic mechanisms are to be used, the market must be constrained by legal and regulatory measures which establish a framework within which the market will take these factors into account. Economic mechanisms have an important role to play among the policy instruments for achieving sustainable development. They can be simpler, clearer and more effective than command and control instruments. They do, however, have their limits in that in particular cases non-economic instruments may achieve the policy objectives more quickly, certainly, cheaply or fairly. Economic mechanisms may reach their limits more quickly where the policy objectives directly involve the non-monetary economy or the poor. With respect to the latter, the reduction of poverty would increase the scope for economic mechanisms.

98. The effectiveness of legal and regulatory mechanisms also depends on the social and institutional context. The choice between economic and regulatory mechanisms therefore depends on the particular conditions of the case.

II. TRANSPORT

The economic and ecological significance of the transport sector

99. The transport sector is economically significant in its own right and it also has important links with other sectors of the economy. In most developing countries, the transport services sector constitutes 5 to 7 per cent of GDP and provides 10 to 20 per cent of total employment in the services sector. Investment in transport infrastructure accounts for about half of all construction activity, which itself makes up half of annual fixed capital formation. At the same time, agricultural and industrial production, the provision of public and private services, and consumption patterns are all dependent upon transport. Past trends show that demand for both passenger and freight transport grows faster than GDP in low-income and middle-income countries.

100. The transport sector is also ecologically significant. Transport activities consume non-renewable resources, particularly oil and coal, and also generate pollution and waste. The magnitude and implications of the environmental impact of the transport sector are worth noting.

101. The transport sector absorbs about 25 to 45 per cent of final commercial energy consumption in most developing countries (table 2.1). Road transport is the main user in the sector. In most developing countries, 35 to 60 per cent of final oil consumption is absorbed by road transport.

102. At a global scale, energy consumption by the transport sector is concentrated in OECD countries, and particularly in the United States of America. The total final energy consumption by the transport sector of all 70 developing countries listed in table 2.2 is equivalent to 58 per cent of the total final energy consumption by the transport sector in the United States.

103. Pollution and waste are generated by various forms by transport activities. There are no general estimates of the contribution of the transport sector to pollution in developing countries. Globally the transport sector in 1987 is estimated to have contributed to greenhouse gas emissions as follows: 17 per cent of CO_2 emissions, 43 per cent of NO_x emissions, and 60 per cent of CO emissions (table 2.2). The NO_x emission of supersonic aircraft also poses a threat to the ozone layer, and research suggests that the expansion of such transport in the stratosphere, associated with a new generation of SSTs, could pose a greater threat to ozone layer depletion than continued use of CFCs. 30/

104. Shipping activity is a significant source of marine pollution. Tanker accidents are the most publicized example, and they have disastrous ecological consequences for the immediate area. But they are not the most important source of oil pollution at sea. In 1980 some 1.6 million tons of oil entered the sea because of transportation activities, and of this total 24 per cent was caused by tanker accidents, 44 per cent by normal tanker operations, usually associated with the cleaning of cargo residues (clingage) when the tanker is returning from the port of discharge to take on another cargo of oil, and 19 per cent by bilge and fuel oil. 31/

105. A further threat arises through the transport of dangerous, hazardous and harmful goods. The IMO estimates that up to 15 per cent of all goods carried on dry cargo ships are dangerous to some degree, and if dangerous chemicals carried in chemical tankers are included, more than 50 per cent of cargoes transported by sea can be regarded as dangerous, hazardous or harmful. 32/

Sustainable development and transport policy

106. In elaborating transport policy, improved accessibility, in the sense of easing the ability of goods and people to reach their required destination, is more important than the facilitation of mobility as an end in itself. There can thus be non-transport solutions to apparent transport problems. Poverty reduction is associated with ensuring that the poorer sections of populations have adequate accessibility to those facilities and opportunities which they require to meet their essential needs.

107. A transport policy designed to promote sustainable development must be concerned with poverty reduction. This concern arises partly from the fact that environmental degradation is related to poverty because poor households are sometimes forced to mis-use the natural environment to ensure their survival. More directly, it arises from the fact that the needs of the poor today are so inadequately met that meeting "the needs of future generations" entails giving priority to poverty reduction. Poverty reduction must be considered in the formulation of transport policy because the supply of transport services affects people's real incomes, their ability to find employment, and also their productive capacities.

108. From the viewpoint of sustainable development, the pattern of transport development in the industrialized rich countries should be regarded in many respects as a model to be avoided rather than a model to be copied. But the table does imply that sustainable growth will require expansion of transport systems and the upgrading of their capability in developing countries. A key aim should be to seek a different quality of growth. 33/

109. Promoting sustainable development thus involves the pursuit of ecological, economic and social objectives. These may be, and often are, in conflict. Adopting sustainable development as a goal of transport policy necessarily involves a process of trade-offs.

Mechanisms for transport policy: overview

110. In implementing transport policy, Governments can use a range of instruments. Governments usually provide and own most of a country's transport in rastructure (roads, railway tracks, ports, canals and airports). A major instrument of transport policy is therefore direct control over provision of facilities, through investment policy.

111. The mobile equipment which uses the infrastructure (e.g. cars, buses, trucks, bicycles) may be privately owned, or (as in the case of railway locomotives, and sometimes buses, trucks, aircraft and ships) publicly owned. Governments can influence the use of this equipment through regulations and controls, such as manufacturers' standards on the nature of vehicles, licenses which regulate entry to markets supplying transport services, road permits

which regulate the type of trips made by lorries, and traffic management measures (e.g. speed limits, night-time lorry bans); market-based incentives, such as taxes on vehicles and fuel, subsidies (e.g. on municipal public transport or company car ownership), and road pricing (e.g. road tolls); institutional measures (called management in Figure 1.2) such as managerial structures of railway and port authorities, management training for small-scale road hauliers, enforcement mechanisms for vehicle standards, and organization structures for road maintenance; research and development (including extension work), on vehicle and road design, and new types of fuel; and information, education and campaigns which influence the demand for transport (e.g. anti-drink-and-drive campaigns).

112. These mechanisms may be applied to influence transport practices in the private sector. They may also be applied directly to public organizations such as railway authorities, port authorities, and municipal bus companies.

113. Investment policies can also be extended beyond public sector investments. There is scope for public sector/private sector partnerships in funding transport infrastructure. Also credit provision to the private sector can have an important influence on patterns of acquisition of vehicles.

114. The range of measures which may be used to achieve the ecological objectives of reduced emissions of pollutants and waste and increased efficiency in the use of non-renewable energy resources include: actions relating to mobile equipment, transport infrastructure and fuel; actions relating to the form of mobility (including driver behaviour, traffic management measures, and measures which influence the split between different modes of transport); and actions relating to the total demand for mobility. The six main mechanisms of transport policy - regulations and controls, market-based incentives, investment policies, R & D, institutional measures, and information/education/campaigns - may be applied to each of these action areas. The mechanisms, in turn, engender effects by influencing technology (e.g. vehicle design) and social organization, (e.g. people's movement patterns, and the location of population, housing and economic activity).

115. Regulations on vehicle exhaust and noise emissions increase vehicle costs, and pricing policies which seek to make road-users pay for negative externalities which they create increase vehicle operating costs. Other measures, such as improved maintenance of roads, or changes in driver behaviour, can lead to both fuel conservation and lower operating costs.

116. Effects on poverty reduction are complex. Some measures, such as the design of road infrastructure so that cyclists or pedestrians are given greater priority, can directly benefit the poor. For other mechanisms the effects may be more difficult to analyse. What is especially relevant is how equipment and infrastructure are used, that is, the nature of transport practices (which is expressed in the form of mobility), and also the total demand for mobility.

117. The total demand for mobility is related to the spatial distribution of population and the spatial pattern of production and consumption. The rate at which demand for transport increases as the economies of developing countries grow will depend on how these spatial patterns change. Urban and regional

policies which do not concentrate urban growth on a few large cities, which for any city, promote urban forms which are not characterized by a low density urban sprawl and the focalization of all activities on a central business district, which coordinate the location of rural health facilities, schools, market-places and storage warehouses in key settlements, particularly small market towns, which encourage efficiency in the location of manufacturing industry, and which encourage small-scale and medium-scale enterprise can all lead to a less transport intensive growth path.

The field of the Polluter Pays Principle

118. The significance of PPP has been explained in chapter I (paras. 58 ff). It has a well-defined sphere of application. It is not a panacea. As Figure 1.2 shows, it is only one of a panoply of mechanisms which can be called upon in working towards the objective of sustainable development. Even the whole set of mechanisms described in chapter I can only go part of the way in that it can only bring to bear the resources available to the economy. The basic problem of sustainable development remains the lack of resources, i.e. poverty.

119. In both developing and developed countries, it is important that users of transport infrastructure pay for the costs associated with its use. A significant distortion is introduced into intermodal competition in that road taxes do not cover the cost of constructing and maintaining road infrastructure. In principle, the social costs of transport, which include air pollution, noise, congestion, and accidents, 34/ should also be borne by transport users. However, it would be wrong to focus exclusively on the Polluter- and User- Pays Principles, or on market-based incentives as the only mechanism for implementing a policy of sustainable development in the transport sector in developing countries.

120. The limits of this approach arise from four factors. Firstly, in many developing countries the transport system is simply inadequate to achieve economic and social objectives. Measures to increase infrastructure provision and the supply of transport services are as important as measures which steer the demand for mobility. Secondly, development entails important structural changes. The most important way in which the demand for mobility may be restrained in developing countries in the long term is through the promotion of a less transport-intensive growth path by influencing the spatial distribution of populations and the spatial distribution of consumption and production. Thirdly, in many developing countries, the majority of the population earn their livelihood from agriculture, and transport costs can significantly affect their economic returns. In most cases, the increased transport charges associated with the internalization of social costs by transport providers would be passed on to agricultural producers. This could lead to greater pressure on the environment, given the organization of agriculture. Thus, in pursuing ecological objectives within the transport sector, negative environmental effects may be engendered in other sectors particularly agriculture. Finally, there is the issue of distributional consequences.

121. In general terms, the increased transport charges associated with the internalization of social costs are likely to have regressive effects. However, the situation is complex in that the only form of transport of the poorest is usually walking. It is possible to design compensation schemes which offset the burden on the poor of increasing transport costs. Other policy mechanisms, such as road investment, can also have regressive effects. It is relevant that investment allocations, institutional measures and research and development can all be targeted in a way that supports poorer groups. Also, the compensation measures which are most practical and least costly in administrative terms are likely to be non-financial mechanisms: such as compensating increased fuel costs by increased accessibility to public transport. These considerations suggest the desirability of a broad policy, including instruments other than market-based incentives.

122. What is required is a pragmatic approach which steers transport practices through a mix of standards, incentives and sanctions and which makes proper use of Government's direct control over infrastructure, with due regard to financial constraints. The following sections briefly illustrate elements of such a pragmatic approach to promoting sustainable development through the transport sector, examining in turn, local-level rural transport policy, international transport policy, and finally, urban transport policy.

Local-level rural transport

123. The inadequacy of the transport systems in many developing countries is most starkly apparent in rural areas. The situation varies from country to country, and within countries transport capabilities vary by region, with areas of export crop production often having better local transport systems. But nevertheless the majority of the rural population of developing countries do not have access to a recognizable road and, as mentioned above, walking is the predominant means of transport for the majority.

124. Surveys have shown that in the Philippines less than half of the villages have access to a road system, in Bangladesh 80 per cent of the villages have no direct access to any mechanized means of transport; in India (1978) about 70 per cent of villages did not have all-weather road connections, and 55 per cent of villages were not connected to any type of road. In Egypt 32 per cent of villages were connected to larger villages, and thence to the road network, but only by footpaths. 35/

125. Recent work has also examined the time which rural households spend upon transport. 36/ Focusing upon the major accessibility needs of rural households - the ability to reach drinking water, a source of firewood, cultivable fields, health, education or crop marketing or processing facilities, purchased supplies (e.g. agricultural inputs, foodstuffs), employment opportunities (especially important for the landless) - it has been shown that internal, "off-road" travel (within the village and between village and fields, water supply, etc.) is more important than external travel, and that the total time spent by rural households on such activity is substantial.

126. Surveys in Tanzania and Ghana have shown that in the former, transport activities occupy 2,600 hours per household per annum and involve a load-carrying effort of 100 metric tons per kilometre; in the latter, where households are twice as large, transport activities occupy 4,800 hours and 200 metric tons per km (Figure 2.1). Most of the work is done by women. In the Tanzanian study areas, the typical able-bodied woman spends 4.3 hours each day solely on transport activities to meet basic accessibility needs, while in Ghana, the typical able-bodied woman spends 2.7 hours per day.

127. The inadequacy of external connections and the high burden of internal transport needs have direct effects on poverty and the environment. In Africa, where women are mainly involved in food production and provisioning their household, the internal transport burden severely cuts into available labour-time, reducing productivity and undermining the ability of rural communities to increase production. There is then an important link at a local level between off-road transport requirements and food security.

128. The inaccessibility of villages to the national road network depresses producer prices of any crops which farmers may market. This occurs directly through the high transport costs which are incurred, particularly when goods are head-loaded, and indirectly because in remote villages, product market structures tend to be less competitive. Traders and transporters can pass on to rural producers the costs associated with any deterioration in rural-urban transport. This can lead to a worsening of the terms of trade at a village level and set in motion a "simple reproduction squeeze".

129. A simple reproduction squeeze occurs when households which are seeking to reproduce themselves and their way of life from year to year are forced to intensify production (by working longer hours and harder) or to reduce consumption (literally "tightening their belts") in order to survive. One immediate effect of the simple reproduction squeeze is reduced investment of effort and funds in maintenance of all kinds, including maintenance of the quality of land. Yields may subsequently decline further, intensifying the squeeze. A simple reproduction squeeze may thus set off a cumulative process of environmental degradation.

130. Policies and mechanisms to improve the rural transport system have traditionally focused upon investment policies, in particular the construction of rural access roads. Such policies have major blind-spots. They ignore the organization of transport services on rural roads; and they ignore requirements for off-road transport. With increasing demands for funds to be diverted from construction of new roads to the maintenance of existing roads, there is a need for new approaches to local-level rural transport provision.

131. Three mechanisms seem particularly appropriate in the context of the promotion of a form of sustainable development which emphasizes poverty reduction. They are:

(a) Technical and financial assistance for the manufacture of intermediate means of transport;

(b) Support for local organizations which can undertake labour-based track and road construction, maintenance and rehabilitation;

(c) Lower cost rural-urban transport links.

132. "Intermediate means of transport" (IMTs) are intermediate between head-loading on foot and conventional motor vehicles, suitable for carrying the small consignments which are carried short distances within village areas. They can play an important role in releasing the off-road transport constraint on agricultural activity. In some developing countries, particular IMTs may be found. In others they do not exist. Promoting their adoption requires, firstly, awareness; secondly, technical engineering inputs, improved access to materials and credit to support small-scale manufacturing and repair capacity; and thirdly, mechanisms to ensure their affordability. This may include design modifications to reduce costs of production; rural credit schemes; or the encouragement of the development of cooperatives to enable farmers to pool their resources.

133. Labour-based road construction, maintenance and rehabilitation is an important way in which simple tracks and village roadways may be provided. Community self-help efforts can make an important contribution in this regard. A major constraint is, however, technical knowledge about techniques of earth road construction and maintenance, and provision of materials for bridges and culverts. Experience with labour-based, as opposed to equipment-intensive, approaches to road construction, maintenance and rehabilitation has also shown that the effectiveness of activities depends on appropriate management systems. These are necessarily of a more decentralized nature than those organizational forms typical of government road maintenance organizations, and important initiatives to make them sustainable include training, and the establishment of essential back-up services in terms of supervision, regular and timely remuneration, and incentives. 37/ Once again, small-scale village contractors can have an important role to play.

134. Reducing the cost of rural-urban transport links is not a simple matter. An important aspect of social organization which achieves this objective automatically is the rural periodic market-place, where people meet once or twice a week, and buyers and sellers engaged in rural-urban trade are concentrated. Pricing policy may have a role to play, in that Government regulations which fix transport charges positively discourage vehicles venturing into some areas because of operating costs and risks of breakdown. It is important in this regard to allow prices to be determined by the market. But the bargaining power of rural communities may be enhanced if there is some local ownership or operation of a motor-vehicle. One possible approach to this, developed in Zimbabwe, is the hiring-out of trucks by district authorities to communities located at a distance from crop purchasing points.

135. Many developing countries may take credit for successes in one or other of the mechanisms described above. Developed countries, on the other hand, have little recent experience with these questions. These are areas with obvious scope for South-South cooperation.

International transport systems

136. Viewed from an international perspective, local-level rural transport can be the first step in a transport system which supports international trade. This transport system includes inland transport by road, rail, and sometimes waterway, to or from a seaport or airport; carriage by sea, by air or by some combination of air-sea transport between countries; and also further inland transport within the territory of trading partners to the origin or destination of freight. For land-locked countries, this system is further complicated, in the case of ocean freight, by overland transport through transit countries to and from seaports.

137. Firms seeking competitive advantage in global markets see transport activities as part of a "value-chain" whose primary activities are in-bound logistics, operations (manufacturing), outbound logistics, marketing and sales, and after-sales service. 38/ These activities are all coordinated and inter-linked. Transport considerations are a logistical function, intimately related to inventory control and cash-flow considerations, and connected to manufacturing operations and marketing and sales. Transport time is often as important as cost (particularly in "just-in-time" manufacturing systems); the availability of specialized facilities, which ensure the quality of a product, and the ability to monitor transport operations are also key requirements for competitive advantage. There is also an increasing demand for intermodal transport systems. Intermodal transport is "a systems approach to all activities and functions in the distribution chain in order to reduce and where possible eliminate interruptions in the continuous movement of goods and transport equipment from origin to destination". 39/ Technical innovations enable changes to be realized in international transport in response to these new demands.

138. There has also been an intensified search for economies of scale, with trans-oceanic liners following bulk carriers in striving for bigger and bigger vessels. Air freight has also become a more and more significant component of international trade, as speed of delivery has become a critical transport requirement.

139. The technical innovations which support changes in the organization of international transport systems are being taken up in some countries, particularly in South and East Asia. The upgrading of transport systems associated with the new innovation is necessarily a selective process, as there is a minimum critical mass of traffic required to support economically viable investment and operations. Shippers also seek to "mass" trade flows in order to increase their efficiency. International corridors with superior services are therefore favouring particular ports in particular countries.

140. As a result, some countries may increasingly be bypassed by the international transport and communications network, albeit bypassed in a relative sense, similar to the experience of towns on a main road connecting two large cities after the cities have been connected by new closed access motorways with no exits at those towns.

141. One possible outcome could be the emergence of a "multipolar but two-track world". 40/ A significant number of the world's poor would be concentrated in the poorer countries which are on the slow, outside track. It is in these countries where the pressures of poverty on environmental degradation will be greatest.

142. The effects of this scenario on poverty can broadly be seen. Nevertheless, the environmental impact of international transport as a sector has hardly begun to be analysed. Work on the impact of urban transport on the environment and the urban poor has been taken much further. In addition to its intrinsic interest, one reason for examining it as is done in the following section is to show by analogy the sort of analysis which would be beneficial with respect to international transport.

Urban transport

143. A critical transport issue facing developing countries is how to meet the transport needs of the growing urban population. It is an issue which will impinge particularly on the urban poor. These are the people who live on pavements, roadsides, river and railway banks, etc. close to the centres of cities in order to be near the places where they can work to gain a living, however insecure. If they are re-settled on the edge of cities they are forced to spend a significant proportion of their income on transport. A survey in Delhi, for example, found that the low-income households with less than 250 rupees per month (which constitute 20 per cent of households in low-income areas and 50 per cent in squatter areas) spend up to 37 per cent of their income and up to 70 per cent of their disposable income for "essential" travel for employment and education purposes. 41/ In that city, public bus services are subsidized, but, where possible, the low-income households walk or cycle.

144. For richer urban households, different transport problems arise, associated with increasing car ownership. There is a close relationship between car ownership and urbanization. At present, car-ownership rates in developing countries are far lower than industrial countries. The growth rates in numbers of passenger cars are stagnant in many poor developing countries, but in some of those in which economic growth is occurring, growth rates of 10 per cent per annum may be observed (table 2.3). Often passenger cars are concentrated in urban areas and localized in a few big cities. For example, in Côte d'Ivoire over 70 per cent of the private cars are concentrated in Abidjan; in Thailand, 74 per cent of the passenger cars are concentrated in Bangkok. 42/

145. Rapid urbanization, the associated transport demands of the poor, and increasing automobile ownership concentrated in cities creates major dilemmas for governments in deciding investment allocation in the transport sector. The increasing demand for transport can divert resources away from rural transport needs and the national transport network. Congestion in large cities can itself act as a constraint on economic performance.

146. Policies and mechanisms for urban transport development include the establishment and management of public transport systems. A range of options exists for public transport, including buses, light rail transit systems, and

metro systems. It has been observed that the public sector is often less cost-efficient in the provision of public transport than the private sector, but it is more effective in its service coverage. Public sector operations can thus be usefully complemented by privately owned and operated transport services, which may include various types of jitneys and minibuses. It is also important that municipal authorities make provision not only for pedestrians but also for bicycles, which are used in a significant proportion of trips in Asia.

147. PPP and market-based incentives have an important role to play in restraining car ownership and usage in urban areas. Both Hong Kong and Singapore indicate practical mechanisms for implementation. 43/ In Hong Kong, the first registration tax for private cars is equivalent to the c.i.f. price of a new car and the annual licence fee amounts to one tenth of this price. Electronic road pricing has been shown to be practical. In Singapore, traffic is restrained through a combination of an area licencing scheme and parking fees.

148. In Los Angeles there are also novel financing schemes in which private-sector property developers contribute to the funding of transport infrastructure. For example, legislation has been enacted to create special "benefit assessment districts" with powers to levy a special tax against landowners and developers whose properties appreciate in value because of proximity to metro rail stations. Funds raised in this way contribute to the construction of the metro rail rapid transit system. 44/ This mechanism internalizes a share of the external benefits of an investment. It expresses the same principles of clear economic signalling as PPP and UPP (see paras. 58-81).

149. The most important mechanism for managing growing urban transport are measures through which the demand for mobility is reduced. Improved communications, associated with investment in telephone equipment, for example, may be part of this. Nevertheless, the most important mechanism is prospective, long-term planning of city development.

150. Global studies of gasoline consumption in cities indicate major disparities in consumption rates per capita (table 3.4). Vehicle efficiency, in terms of petroleum consumption per kilometre, explains some of this variation. Part of the variation can also be attributed to lower gasoline prices and higher income per capita in the cities with high consumption rates. But only half of the variation in gasoline use is explained by these economic factors. The more important factor is urban configuration. 45/

151. This implies that a purely economic approach to reduce gasoline consumption will be insufficient. The physical urban form creates a situation of automobile dependence. To avoid automobile dependence, it is necessary to prevent low-density urban sprawl and to encourage a better mix, within neighbourhoods and communities, of services, housing and jobs, so that requirements for long journeys to a central business district are substantially reduced. An important goal should be to improve people's accessibility to employment and facilities which meet essential needs. This entails not just the management of mobility per se, but also land-use planning and community development schemes.

152. A precondition for such planning is institutional reform. Measures to improve the financial basis of municipal government are important in this regard. Coordination between authorities responsible for transportation and housing development is also vital.

Relations between mechanisms, policies and objectives

153. The demand for transport is a derived demand. It depends on the organization and distribution of production in agriculture, industry, and services, and the distribution of population and consumption. Increased specialization, the commercialization of agriculture, the spatial separation of production and consumption, the development of external trade, the provision of education and health facilities and the rising personal mobility requirements associated with rising living standards all increase the demand for transport.

154. The availability of transport does not cause development. Rather the transport sector is an enabling sector. The availability and adequacy of transport services are necessary conditions for certain social and economic changes to take place.

155. Transport shortages, congestion and bottlenecks can all undermine the achievement of national economic and social objectives. Deterioration of roads associated with inadequate maintenance, and the breakdown of a national fleet of vehicles and rolling-stock not only create capacity constraints but also influence the way internal markets operate. Port congestion can disrupt efforts to promote export-oriented growth in spite of an appropriate macroeconomic framework.

156. In adopting sustainable development as a goal of policy for the transport sector, Governments must seek to facilitate the development of a transport system that provides services which producers and consumers need and it must be done in a way that is economically efficient, socially equitable and ecologically stable. The economic, social and ecological objectives may conflict. For this reason the formulation of transport policy entails the negotiation of trade-offs. In managing these trade-offs, improved accessibility, in the sense of easing the ability of people to reach their required destinations, is of course more important than management of mobility as an end in itself.

157. Ecological considerations are important within transport policy, and the Governments of developing countries should seek to ensure that their transport expansion does not replicate the mistakes of many industrialized countries. However, it would be wrong for Governments totally to subordinate environmental concerns to other objectives of transport policy.

158. This consideration is particularly pertinent because of the linkages between transport and other sectors. It is possible, for example, to pursue a goal of reduced waste emissions and conservation of non-renewable sources of energy, but in such a way that transport costs are increased and greater pressure is put on small-scale farmers to over-exploit their land. Negotiating the trade-offs between economic efficiency, social equity and ecological stability means paying attention to complex interrelationships. An

overriding concern should be to promote the development of a transport system which supports a shift in the productive base of the economy away from simple and direct dependence on natural resource exploitation.

159. It is important that, in pursuing the goal of sustainable development, Governments adopt a pragmatic, rather than dogmatic approach. Within the transport sector the policy choice between "command and control" on the one hand, and "market-based instruments" on the other hand should not be polarized. Both have a place in policy implementation. Governments have a range of mechanisms through which they can facilitate and guide both the demand for, and the supply of, transport services.

160. The main mechanisms for implementing transport policy are: regulations and controls; market-based incentives which influence prices and costs; institutional measures; investment policies, including public sector investments, public sector -- private sector partnerships and credit provision to the private sector; research and development including extension work; and information, education and campaigns.

161. Investment policies are particularly important as Governments usually provide and own most of a country's transport infrastructure. Also important is the creation of institutions which are flexible and responsive to change, and which can also coordinate well with other, not necessarily transport-oriented institutions. Investment policies, institutional reforms and research and development can also be easily targeted in a way that supports poorer groups.

162. Getting the prices right in an environmental sense, that is, by internalizing the negative externalities associated with transport, is important, but is not sufficient in itself as a mechanism for implementing transport policy aimed at sustainable development. While this approach has a role to play in developing countries, its applicability is greatest in the management of urban transport problems.

163. The three main action areas to which the instruments of transport policy may be applied are: actions relating to mobile equipment, transport infrastructure and fuel; actions relating to the form of mobility (including traffic management measures and modal split); and actions relating to the total demand for mobility, i.e. accessibility. Whatever the mix of policy instruments adopted, it is important that they be applied to all three action areas.

164. In relation to the issue of fuel conservation, for example, appropriate policy would involve firstly, the implementation of standards for fuel-efficient vehicles; secondly, the facilitation of fuel-efficient traffic flows and the encouragement of a modal split in which more traffic was carried on fuel-efficient modes of transport; and, thirdly, support for the development of fuel-efficient cities (in terms of their land-use and housing patterns), and, more broadly, promotion of a fuel-efficient society.

165. The experience of industrialized countries in this regard is that environmental protection measures which focus upon the first action area, such as emissions standards for vehicles and environmental impact assessments of

new infrastructure and related corrections in design are insufficient in achieving ecological objectives. Even when they are implemented, growth in traffic and trips results in increasing waste emissions and energy consumption. It is therefore necessary that an environmentally sensitive transport policy should also be concerned with the form of mobility and the total demand for mobility.

166. Measures to influence the form of mobility and accessibility, or the total demand for mobility, can engender a different quality of growth to that which has been experienced by the now industrialized countries. A pressing concern is the need to avoid the automobile dependency which is likely to be concomitant with rising urbanization.

167. In a long-term perspective, the most important action area to promote sustainable development is the total demand for mobility. It is in this area that there is often the greatest danger in applying command and control instruments and using subsidies as a market-based incentive. Other mechanisms are preferable, but the issue goes well beyond mechanisms. In terms of figure 1.1, improved accessibility, especially for the poor in both rural and urban areas, is a goal. Policies and mechanisms need to be chosen in the context of a strategy to meet that goal.

Notes

1/ The other key concept is that of "needs, in particular the essential needs of the world's poor, to which overriding priority should be given". World Commission on Environment and Development, Our Common Future, Oxford, Oxford University Press, 1987, p. 43.

2/ Johan Galtung, Development, Environment and Technology (TD/B/C.6/23/Rev.1) 1979, chap. I.

3/ Sustainable Development and UNCTAD Activities (TD/B/1267), paras. 19-29.

4/ cf. TD/B/1267, para. 30.

5/ United Nations Centre on Transnational Corporations, Criteria for sustainable development management, United Nations, New York, 1991.

6/ In this passage, the "interest rate", "internal rate of return" and "discount rate" are used interchangeably.

7/ ST/STAT/SER.F/2/Rev.3/Corr.1.

8/ World Resources Institute, World Resources 1990-91, p. 232.

9/ Convention 169.

10/ See footnote 1.

11/ In this section, the words in italics correspond to particular entries in Figure 2.2.

12/ Our Common Future op. cit. p. 43.

13/ See Chapter II.

14/ OECD Council Recommendation of the Council on the use of economic instruments in environmental policy (C(90) 177, Annex 1, para. 9).

15/ OECD Environmental Committee at Ministerial Level, 30-31 January 1991, Communiqué para. 38.

16/ OECD, Guidelines for the application of economic instruments in environmental policy, Environment Committee meeting at ministerial level, 30-31 January 1991, Background paper No. 1, p. 7'.

17/ OECD Council Recommendation C(90)177, Annex 1, para. 8.

18/ Launched at the Second World Industry Conference on Environmental Management, Rotterdam, 10-12 April 1991.

19/ Recommendation of the Council on guiding principles concerning international economic aspects of environmental policies, adopted by the OECD Council at its 293rd meeting, on 26 May 1972.

20/ Note on the implementation of the Polluter-Pays Principle, OECD Recommendation, para. 8, op. cit., footnote 19 above.

21/ Recommendation of the OECD Council on the implementation of the Polluter-Pays Principle, adopted at its 372nd meeting, on 14 November 1974.

22/ The following argument is based on Pearce, David, "Economic incentives and renewable natural resource management", in Renewable natural resources, OECD, 1989; and Turner, Kerry, "Economics and wetland management", Ambio, Vol. 20, No. 2, April 1991.

23/ It should be noted that the word "user" has rather different senses in the terms "User cost" and "User Pays Principle", as employed by OECD.

24/ Pearce, op. cit., p. 14.

25/ Turner, op. cit., pp. 60-61.

26/ Some authors prefer the term "market-based incentives". The two terms are used interchangeably in this report.

27/ See above.

28/ OECD, Economic Instruments for Environmental Protection, Paris 1989.

29/ Examples can be found in WMO, Climate, Urbanization and Man, Geneva, n.d.

30/ "Worth the Earth?", Flight International, 2-8 January 1991, pp. 25-26.

31/ "Preventing Marine Pollution", Focus on IMO, September 1989.

32/ "The Safe Transport of Dangerous, Hazardous and Harmful Cargoes by Sea", Focus on IMO, August 1990.

33/ Our Common Future, pp. 52-54 op. cit.

34/ Road accidents are one of the leading causes of death in developing countries, particularly in the economically active group and they are estimated to cost countries at least 1 per cent of their GNP. Fatality rates are on average 20 times higher than those of developed countries. Transport and Road Research Laboratory "Work of the Road Safety Section (Overseas Unit)", Bulletin LF2007, October 1989.

35/ Barwell, I.J. et al. Rural Transport in Developing Countries, Intermediate Technology Publications 1985, p. 127.

36/ This pioneering work has been done by the Intermediate Technology Transport Ltd., Abingdon, Oxford.

37/ J. De Veen, "Appropriate Use of Available Resources and Technology", SSATP Road Maintenance Initiative. World Bank/ECA 1989.

38/ Porter, M. The Competitive Advantage of Nations, Macmillan, London, 1990.

39/ CEPAL, The International Common Carrier Transportation Industry and the Competitiveness of the Foreign Trade of the Countries of Latin America and the Caribbean, LC/G.1575.P, November 1989.

40/ Emmerij, L. One World or Several? OECD, 1989.

41/ Maunder "Public transport needs of the urban poor in Delhi, India," in CODATN, Third Conference on Urban Transport in Developing Countries, Cairo, 20-23 January 1986.

42/ United Nations. Urban Transport Development with Particular Reference to Developing Countries, 1989.

43/ OECD, Cities and Transport, 1988, chapters 3 and 10.

44/ OECD, Cities and Transport, 1988, p. 86.

45/ P.W.G. Newman and J.R. Kenworthy, 1989. Cities and Automobile Dependence: An International Sourcebook. Cromer Brookfield.

Annex

Figure 1.1

Definition of terms

GOAL	=	AN OBJECTIVE TO BE ACHIEVED
STRATEGY	=	A BROAD PLAN TO ACHIEVE A GOAL
POLICY	=	A SPECIFIC COURSE OF ACTION TO IMPLEMENT A STRATEGY
MECHANISM	=	A PARTICULAR MEANS OF IMPLEMENTING A POLICY

Adapted from Goldenberg, Jose, T.B. Johanssen, A.K.N. Reddy and R.H. Williams, Energy for a sustainable world, New Delhi, Wiley Eastern, 1988, Figure 5.1.

Figure 1.2

MECHANISMS FOR IMPLEMENTING ENVIRONMENTAL POLICY

An Illustrative Diagram

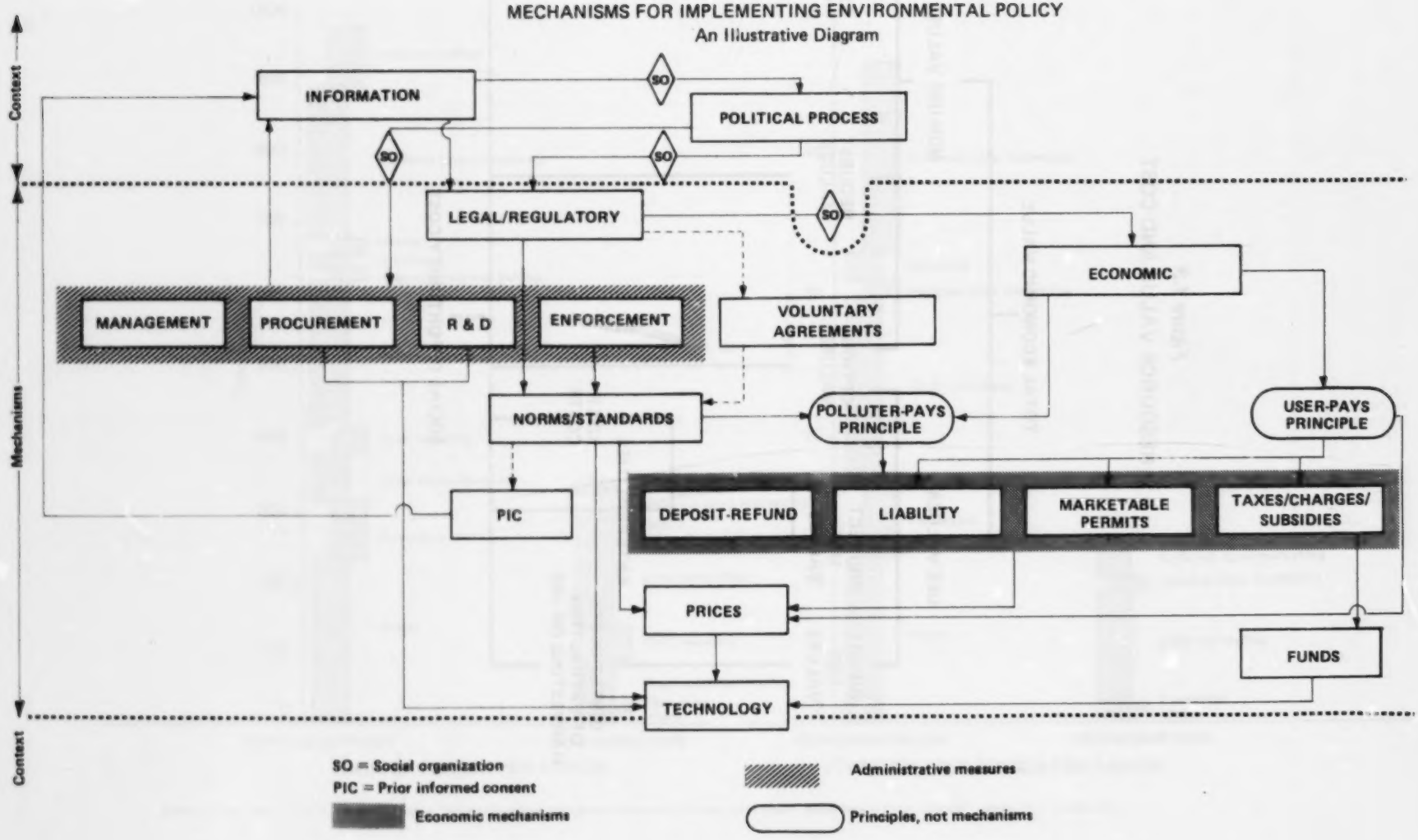


Figure 1.3

RESOURCE VALUE AND COST

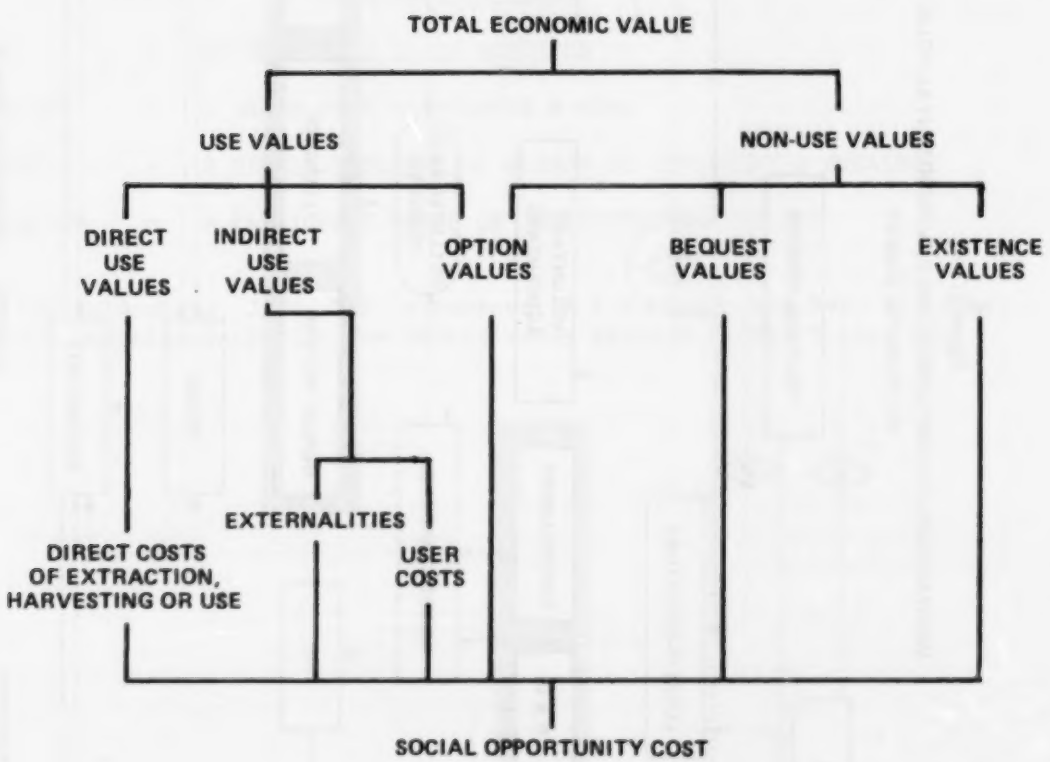
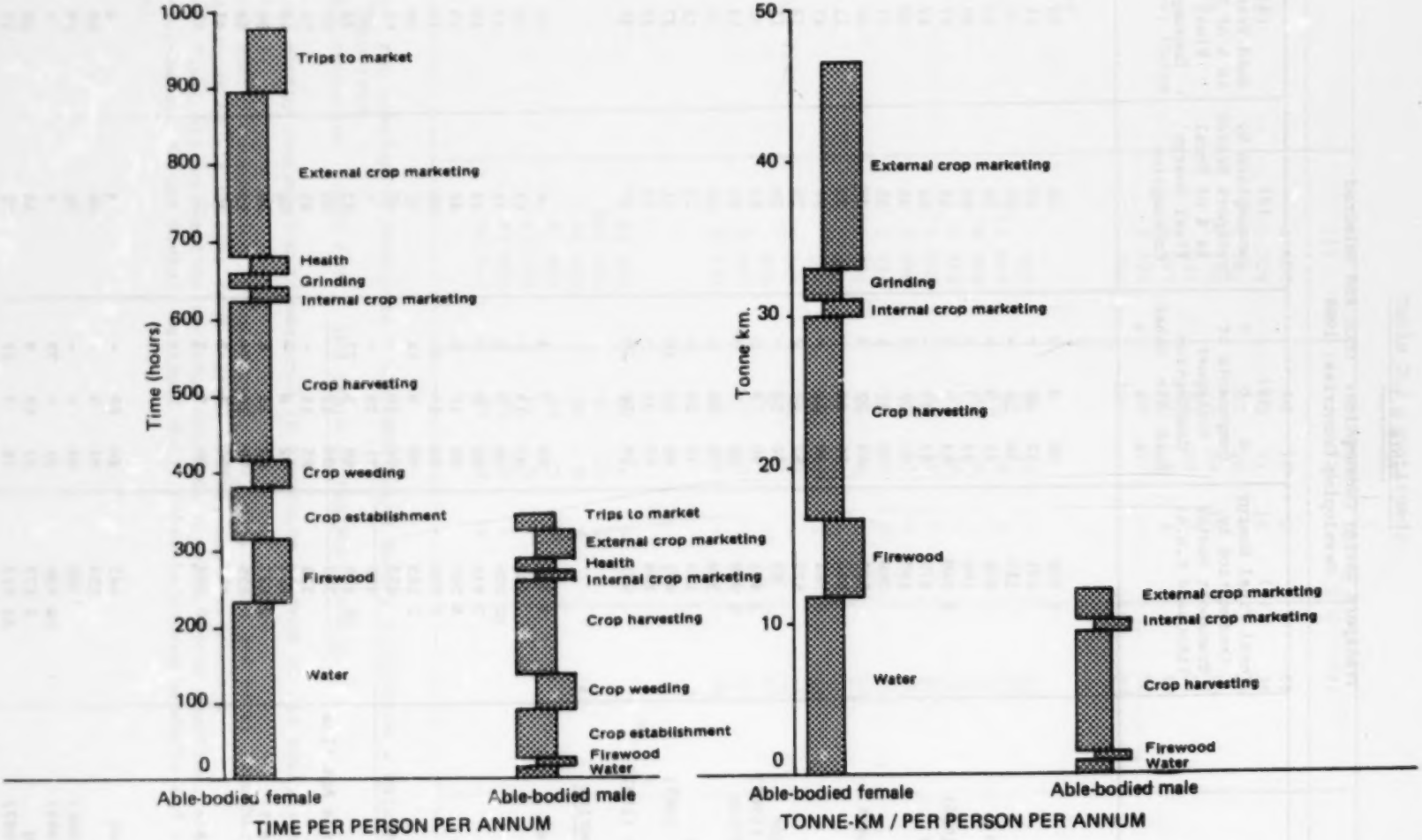


Figure 2.1

TRANSPORT ACTIVITIES OF ABLE-BODIED ADULT MALES AND FEMALES (GHANA)



Source: Harrison, P. & J. Howe, (1989) "Measuring the transport demands of the rural poor: experience from Africa", Gate, No. 1, pp 3-6

Table 2.1

Transport Energy Consumption: OECD and Selected Developing Countries, 1988

	(1) Total Final Energy Consumption by Transport Sector (thousand t.o.e)	(2) a Components of Transport Consumption Road %	b Air %	c Other %	(3) Consumption by Transport Sector as % of Total Final Energy Consumption	(4) Road Transport as % of Total Final Oil Consumption
Africa						
Algeria	4 508	90	8	2	40	53
Angola	331	52	48	-	49	41
Benin	119	86	14	-	80	75
Cameroon	554	91	9	-	56	64
Congo	198	93	7	-	85	90
Egypt (1986)	4 348	84	9	7	24	27
Ethiopia	470	63	37	-	61	42
Gabon	195	66	25	9	48	38
Ghana	268	88	11	1	25	33
Ivory Coast	523	69	22	9	49	40
Kenya	626	56	44	-	32	21
Libya	2 564	88	12	-	30	47
Morocco	625	62	36	2	16	12
Mozambique	83	46	54	-	18	11
Nigeria (1987)	5 481	90	8	2	53	52
South Africa	9 909	86	7	7	23	54
Sudan	398	72	28	-	26	20
Tanzania	132	75	25	-	23	19
Tunisia (1987)	871	66	18	16	31	27
Zambia	184	69	31	-	13	22
Zimbabwe (1987)	633	54	16	30	23	46
Latin America						
Argentina	9 701	89	7	4	30	52
Bolivia	649	87	13	-	53	64
Brazil	30 006	88	7	5	36	47
Chile	2 830	85	8	7	39	49
Colombia	5 565	88	10	2	40	55
Cuba	1 906	66	13	21	25	19
Ecuador	2 185	68	8	24	51	38
Guatemala	455	90	10	-	57	61
Jamaica	495	71	29	-	-	29
Mexico	25 478	68	5	27	33	32
Netherlands Antilles	373	88	12	-	55	57
Panama	323	85	15	-	45	51
Paraguay	432	92	8	-	65	78
Peru (1987)	2 627	83	11	6	36	38
Trinidad	525	90	10	-	15	69
Uruguay	487	90	7	3	35	41
Venezuala	10 564	90	9	1	39	61
Asia						
Bangladesh	143	40	60	-	4	4
Brunei	184	91	9	-	50	59
Burma (1986)	705	94	6	-	34	59
China (1985)	24 536	21	-	79	5	7
Hong Kong	2 173	22	69	9	33	10
India (1987)	23 513	70	7	23	25	37
Indonesia	9 133	09	8	2	34	45
Malaysia	4 334	90	10	-	41	49
Nepal	81	68	32	-	30	30
N. Korea	2 333	100	-	-	8	73

Table 2.1 (continued)

	(1)	(2)			(3)	(4)
Pakistan	4 682	84	10	6	26	51
Philippines	1 749	63	21	16	23	20
Singapore	2 540	46	54	-	49	27
South Korea	11 156	72	13	15	20	26
Sri Lanka	831	84	13	3	61	60
Taiwan Prov. China	5 587	91	5	4	19	30
Thailand	9 224	80	17	-	56	56
Vietnam	786	100	-	-	20	53
Middle East						
Bahrain	722	41	59	-	22	38
Iran	11 664	96	4	-	23	32
Iraq	8 388	92	8	-	45	54
Israel	3 051	76	24	-	48	49
Jordan	1 189	83	17	-	52	48
Kuwait	1 980	83	17	-	35	69
Lebanon	1 260	99	1	-	71	86
N. Yemen	691	92	8	-	64	62
Oman	481	76	24	-	24	49
Quatar	535	83	17	-	14	43
Saudi Arabia (1987)	12 117	90	10	-	31	38
S. Yemen	678	81	9	-	64	54
Syria	2 451	97	3	-	45	48
UAR	4 733	75	25	-	68	69
OECD						
Canada	42 000	80	11	5		
USA	482 000	82	15	2		
France	40 000	86	9	3		
Germany	49 000	87	10	3		
Italy	32 000	91	5	2		
UK	43 000	80	15	2		
Japan	66 000	85	4	4		

Source: For developing countries - IAE/OECD World Energy Statistics & Balances 1985-1988, OECD 1990.
For OECD countries - OECD 1991, The State of the Environment.

Notes: Final energy consumption is measured in thousands of tons of oil equivalent (thousand t.o.e.).
Total energy consumption includes coal, oil, gas, hydro and other (geothermal, solar and output of electricity from vegetal fuels), and electricity.
Total final oil consumption includes NGL/LPG, naphtha, motor gasoline, aviation fuels, kerosene, gas diesel, residual fuel, other petroleum products and refinery fuel.

Table 2.2

The Transport Sector and Greenhouse Gas Emissions

Year: 1987	Greenhouse Gas Emissions Attributable to Transport Sector			Greenhouse Gas Emissions Attributable to All Sectors		
	(1) OECD	(2) Non-OECD	(3) World	(4) OECD	(5) Non-OECD	(6) World
CO_2 (Xt of C)	600	400	1 000	2 713	3 287	6 000
NO_x (Xt of NO_x)	20	14	34	38	42	80
CO (Xt of CO)	128	77	205	143	199	342

Source: IAE/OECD Greenhouse Gas Emissions: The Energy Dimension. A Working Paper to the White House Conference on Science and Economic Research related to Global Change, 17-18 April 1990.